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From Indigenous Knowledge to Intelligent Ethnobotany: Emerging Horizons for Artificial Intelligence in Ethnobotanical Research

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Ethnobotany has emerged at the intersection of people, plants, and ecosystems, generating over generations a rich body of knowledge concerning the identification, use, management, and cultural significance of plants across diverse societies. Yet much of this knowledge heritage continues to be transmitted through oral traditions, local experience, and intergenerational memory. It is increasingly vulnerable to erosion and loss in the face of globalization, migration, climate change, and rapidly changing lifestyles. Against this backdrop, digital technologies and artificial intelligence (AI) in particular—offer new

opportunities to preserve, organize, and analyse this invaluable heritage.

The rapid development of artificial intelligence (AI), machine learning (ML), mobile technologies, natural language processing, cheminformatics, and omics-based approaches has created new opportunities for ethnobotany to move beyond fragmented data collection toward a more integrated, data-driven knowledge framework (Kour et al., 2026). In the field, a mobile device can function as an integrated platform for simultaneously recording plant images, local names, audio recordings, geographic coordinates,

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traditional uses, and preparation methods. Intelligent algorithms can subsequently assist with preliminary plant identification, speech-to-text conversion, translation, classification, and data organization (Böhlen & Sujarwo, 2020). In this context, technology does more than accelerate data collection; it may also facilitate the documentation of knowledge from communities that have historically been underrepresented in scientific research because of linguistic, geographic, or infrastructural barriers (Hart et al., 2025).

The greater significance of AI, however, lies in its analytical potential. When ethnobotanical information is integrated with botanical, geographic, phytochemical, and pharmacological datasets, computational approaches may reveal relationships and patterns that are difficult to discern within relatively small or isolated datasets (da Silva, 2026). Such approaches may help identify species associated with similar uses, highlight potentially relevant phytochemical constituents, and reveal gaps in existing knowledge, thereby informing the prioritization of species for subsequent phytochemical and pharmacological investigation (Böhlen & Sujarwo, 2020). From this perspective, ethnobotany could move beyond a predominantly descriptive discipline toward a more analytical, network-oriented, and hypothesis-generating field.

One of the most promising directions is the convergence of ethnobotany with drug discovery. Approaches such as quantitative structure–activity relationship (QSAR) modelling, molecular docking, virtual screening, network analysis, and ADMET prediction, when considered alongside genomic, transcriptomic, proteomic, and metabolomic data, may contribute to generating and prioritizing biologically relevant hypotheses (Pawar et al., 2026, Russell et al., 2013). Nevertheless, one fundamental principle must remain clear: a computational prediction is not equivalent to scientific evidence. The output of an AI system or computational model should serve as a starting point for experimental investigation and validation rather than as a substitute for either. Accordingly, the prospective research pathway can be conceptualized as a continuum: indigenous knowledge → data generation → intelligent analysis → hypothesis generation → laboratory validation →

preclinical evaluation and, where warranted, clinical investigation.

Alongside these developments, the emerging concept of digital ethnobiology may provide a framework for examining relationships among people, living organisms, and their environments within digital and virtual settings. Over recent decades, the internet, telecommunications, and social media have facilitated the formation of digital communities and the exchange of biocultural knowledge, perspectives, and experiences. From this standpoint, ethnobiological research need not be confined to interactions occurring within physical communities and landscapes; digital environments can also constitute research settings in which biocultural knowledge is produced, transmitted, transformed, and reproduced. Digital ethnobiology may therefore be understood as an emerging field concerned with the study of dynamic relationships among humans, living organisms, and environments as these relationships are expressed and mediated through digital and virtual platforms. Yet the future of intelligent ethnobotany is not solely a technological question. Indigenous knowledge carries cultural, social, and, in some contexts, economic value, and its digitization raises important concerns regarding informed consent, intellectual property, data governance, confidentiality, attribution, and equitable benefit sharing. Local and Indigenous communities should not be treated merely as sources of data; rather, they should have meaningful involvement in research design, interpretation of findings, and decisions concerning access to and use of their knowledge and associated data (Bhadmus et al., 2026). Future systems must also be multilingual and culturally sensitive, ensuring that the digitization of knowledge does not inadvertently erase local names, Indigenous concepts, contextual meanings, or cultural diversity.

From this perspective, a clear roadmap for future research is beginning to emerge: intelligent documentation, data standardization, integration of heterogeneous information sources, computational analysis, hypothesis generation, empirical validation, and ethical data governance should be brought together within a coherent research continuum.

The objective is not to replace researchers or Indigenous knowledge with artificial intelligence, but to foster meaningful collaboration among knowledge-holding communities, researchers, and technological systems.

Future ethnobotany may therefore extend well beyond the conventional recording of “plant names and traditional uses” and evolve into a dynamic knowledge network in which Indigenous knowledge, field observations, laboratory evidence, and computational analyses are brought together. The central question of the future may no longer be limited to *which plants do communities know, and how do they use them?* Instead, a broader question emerges: How can humanity’s bicultural knowledge be transformed into a dynamic body of knowledge capable of informing future scientific inquiry while preserving its provenance, cultural context, and the rights of those who hold it? This question may mark the beginning of a new generation of research in digital ethnobiology and intelligent ethnobotany.

Declarations Conflict of Interest

The authors declare no conflicts of interest.

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Authors’ Contributions

The author conceived and developed the idea, drafted and critically revised the manuscript, and approved the final version.

AI Use Disclosure

None.

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